



*Presented to:*  
**American Helicopter Society**

# ***Future Directions in Tactical Vertical Lift***

"Approved for public release; distribution unlimited. Review completed by the  
AMRDEC Public Affairs Office 28 April 2010; FN4617"



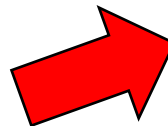
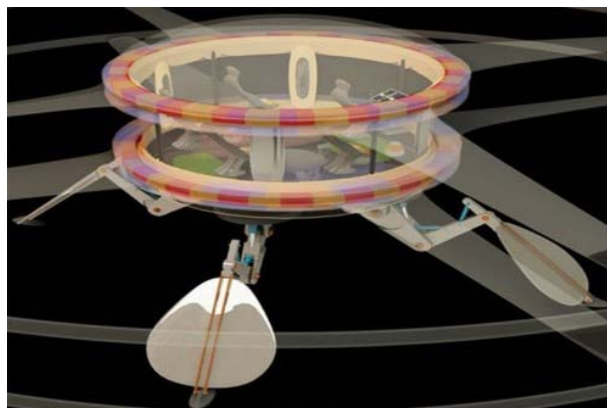
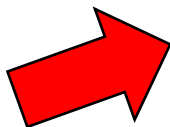
***TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.***

Date 29 April 2010

*Presented by:*  
**Jim Snider**  
Director for Aviation Development  
Aviation and Missile Research,  
Development and Engineering Center

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>29 APR 2010</b>		2. REPORT TYPE		3. DATES COVERED <b>00-00-2010 to 00-00-2010</b>	
4. TITLE AND SUBTITLE <b>Future Directions in Tactical Vertical Lift</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Army Research Development &amp; Engineering Command,Aviation and Missile Research, Development and Engineering Center,Redstone Arsenal,AL,35898</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>24</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

# How to Think About Future Tactical Vertical Lift

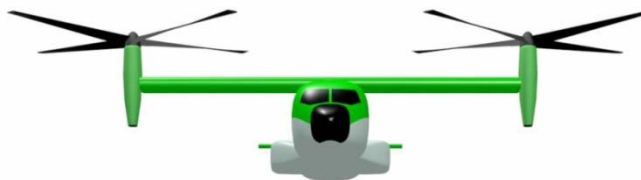
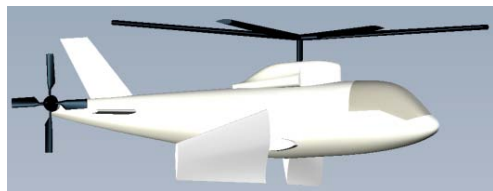


- **Current Initiatives / Programs**
- **The Aviation Science and Technology Challenge**
- **OSD Future Vertical Lift**
- **Transition to the Future**



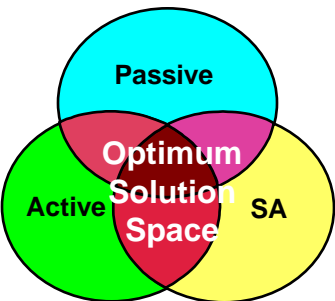
# Current Initiatives Shaping the Future

- US Army Aviation Center of Excellence (USAACE)  
Aviation Operations Capability Based Assessment (CBA)
- USAACE Joint Multi-Role (JMR) Aircraft Analysis Study
- DARPA/Army Study on the Future of VTOL Aviation
- OSD Future Vertical Lift Initiative
- Army Aviation JMR Demonstrator Program



- Operations and Support
- CBM
  - Rotor Durability

## Advanced Technology Demonstration Efforts \$550M



- Aircraft Survivability Equipment
- Aircraft & Crew Protection

### Applied Research \$316M

Human machine Interface

System concept studies

Reduced O&S Technologies

Advanced R/W Concept

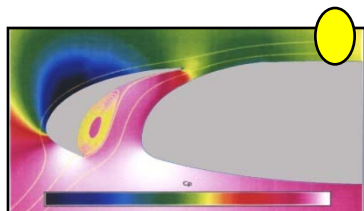
Propulsion & Drives

Rotorcraft & Aircrew Survivability

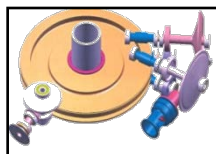
Rotors & Flight Controls



### Aviation Weapons Integration



- Rotors & Flight Control:**
- Adaptive Vehicle Management
  - Optimal Speed Rotor
  - Reconfigurable Rotors
  - High Performance R/W Designs



- Propulsion & Drives Technologies**
- Transmissions
  - Engines

- Unmanned Systems**
- Unmanned-Manned Teaming/Autonomy
  - Airspace Control



*Joint Future  
Operational Environment*

**MOUNTAINS & DESERTS**



**JUNGLES &  
DENSE FORESTS**



**POOR  
INFRASTRUCTURE**



**COMPLEX  
DEMOGRAPHICS**



**The future operational environment demands  
simultaneous, distributed, non-contiguous operations**

**CITIES**



**Increased reliance on force projection by Aviation**



- “Army Aviation is the service's most requested asset around the globe, ..... some units are spending as much time on deployments as they do at home.” General James D. Thurman
- “I want vertical lift aircraft that fly faster, go farther and carry more stuff” Colonel Clay Hutmacher, Commander 160<sup>th</sup> Special Operations Aviation Regiment .... *Note: The 160<sup>th</sup> SOAR has been engaged continuously in combat operations since September 2001.*



## Commanding General's Intent

- We need an affordable and effective integrated pilotage system across the fleet, to enhance full spectrum operations, especially in degraded visual environments.
- It is paramount that all Aviation S&T efforts are focused, integrated, and synchronized. We must quit piecemealing component technologies and develop an integrated effort which considers all facets necessary to fielding a capability



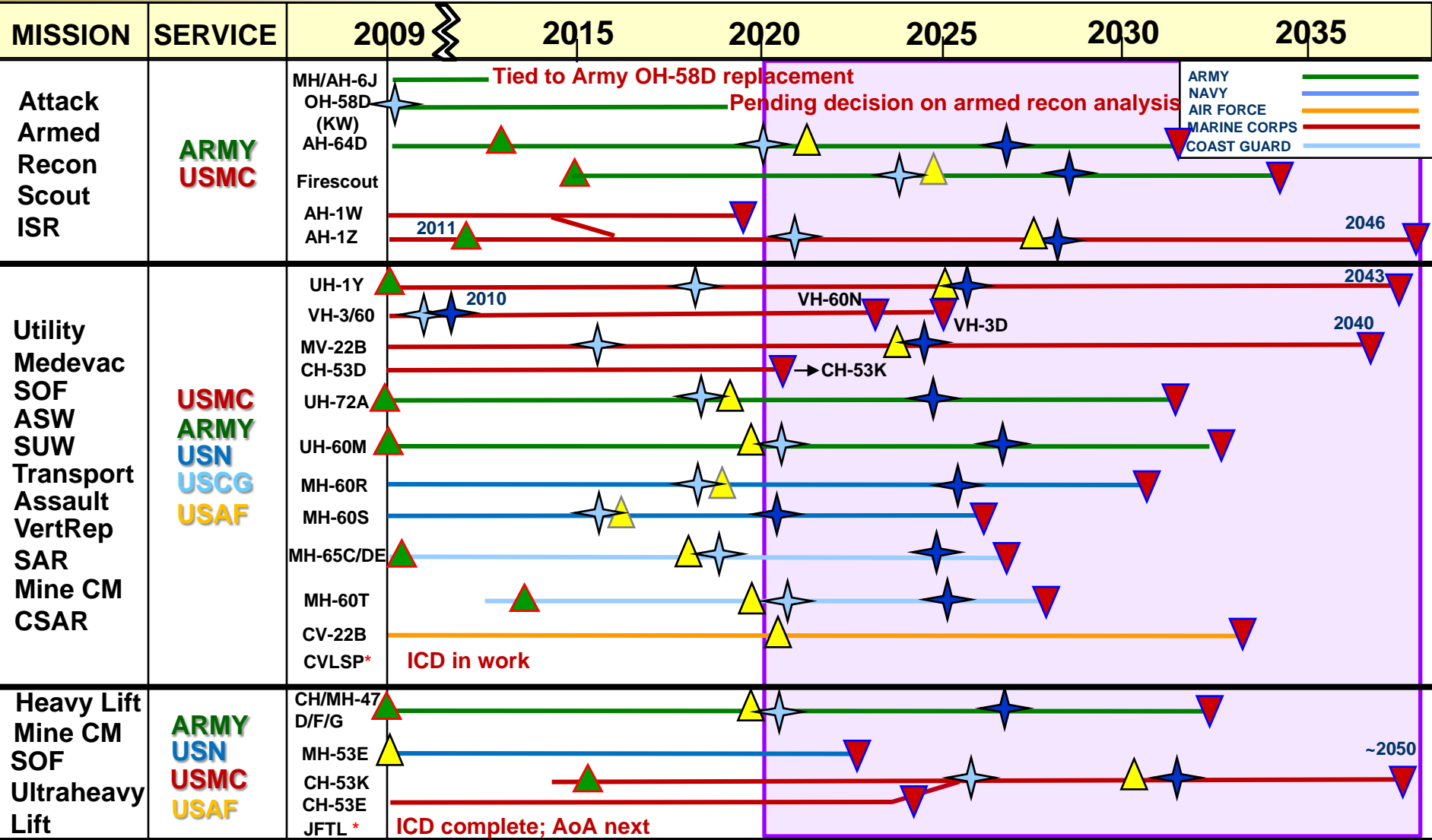
## Commanding General's Intent

- The biggest impediment for rapid insertion of technology into our aircraft is the platform specific, proprietary architectures that require us to develop, test and field unique solutions for incorporation of technology improvements.
- Aviation platforms, must perform these tasks to standard, worldwide, in conditions ranging from standard sea level to high/hot (6k Pressure Altitude / 95 Deg F) across the full spectrum of environmental conditions.
- The utility and cargo fleet should carry their combat loads up to a 424 km unrefueled radius with 30 minutes station time; while, attack and reconnaissance aircraft should meet the 424 km unrefueled radius with 120 minutes station time.



# The S&T Challenge

## Future Aviation Decision Points







## 2009 National Defense Authorization Act

The Congressional Rotorcraft Caucus is concerned about the **lack of a strategic plan for vertical lift aircraft** in the US



## SECDEF Memorandum

I have directed OSD to lead the development of a CBA to **outline an approach to future development of vertical lift aircraft** for all Services



## OSD Future Vertical Lift ESG

Rotorcraft  
Survivability Study  
AUG '09

Capabilities  
Based  
Assessment  
NOV '09

S&T Plan  
JUN '10

Strategic Plan  
JUL '10



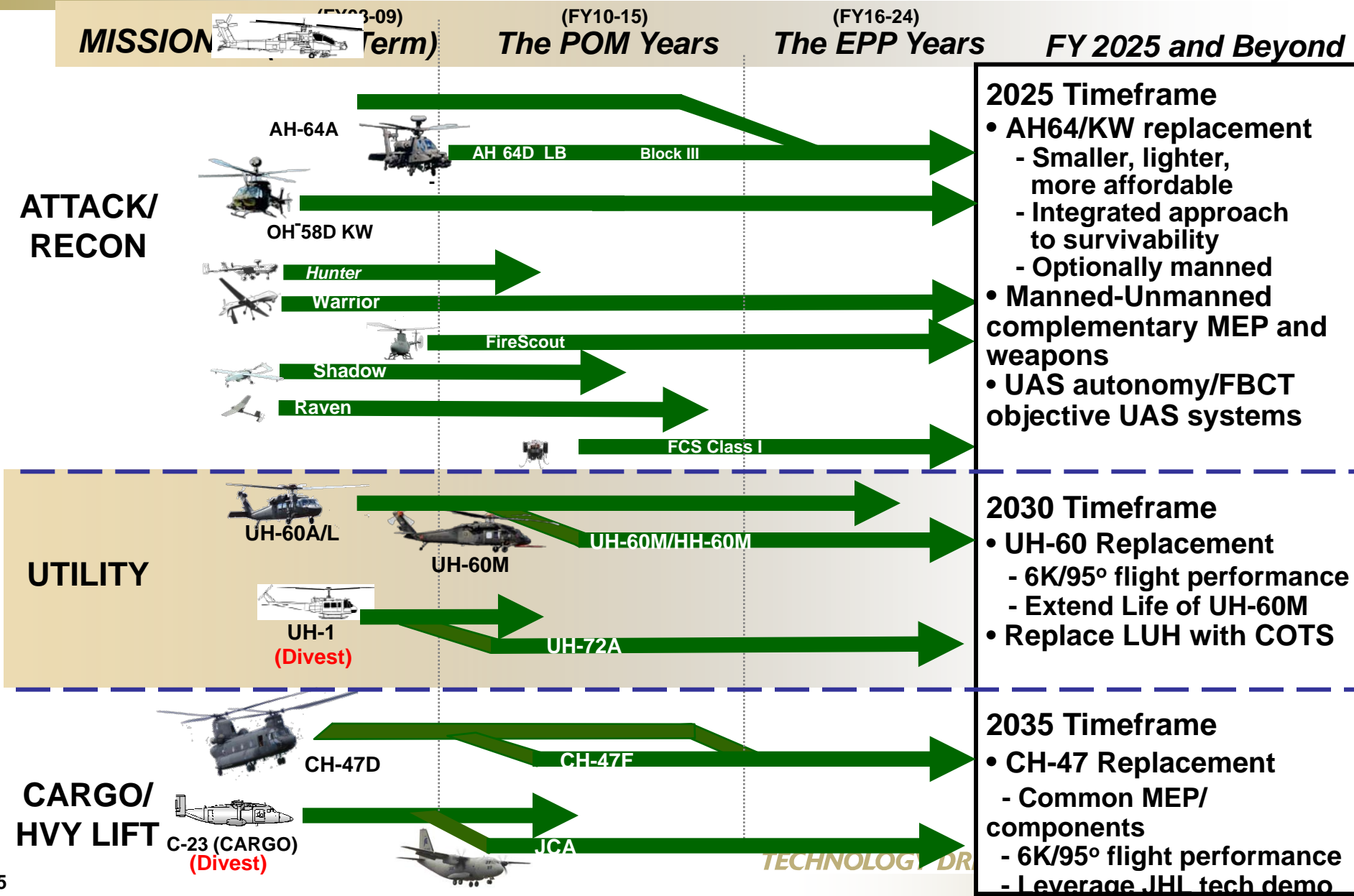
## VLC Board of Directors

Robert Lindberg, National Institute of Aerospace	Academic/Nonprofit
Daniel Schrage, Georgia Tech	Academic/Nonprofit
M.E. Rhett Flater, AHS International	AHS
Fred Dickens, Rolls-Royce Corporation	Engine
Scott Rettig, AgustaWestland NA	Large Contractor
Stephen Mundt, EADS North America	Large Contractor
Robert Wood, Northrop Grumman	Large Contractor
Nick Lappos, Bell Helicopter	Large OEMs
Eric Streich, The Boeing Company	Large OEMs
Dan Spoor, Lockheed Martin	Large OEMs
Mark Miller, Sikorsky Aircraft Corporation	Large OEMs
Rudolph Ostovich, Parker Ostovich +Associates	NT Contractor
Doug Baldwin, Baldwin Technology Company	NT Contractor
John Piasecki, Piasecki Aircraft Corporation	Small VTOL R&D
Ed Fortunato, Honeywell	Supplier
Kip Freeman, Goodrich Corporation	Supplier

# THE ARMY RESPONSE

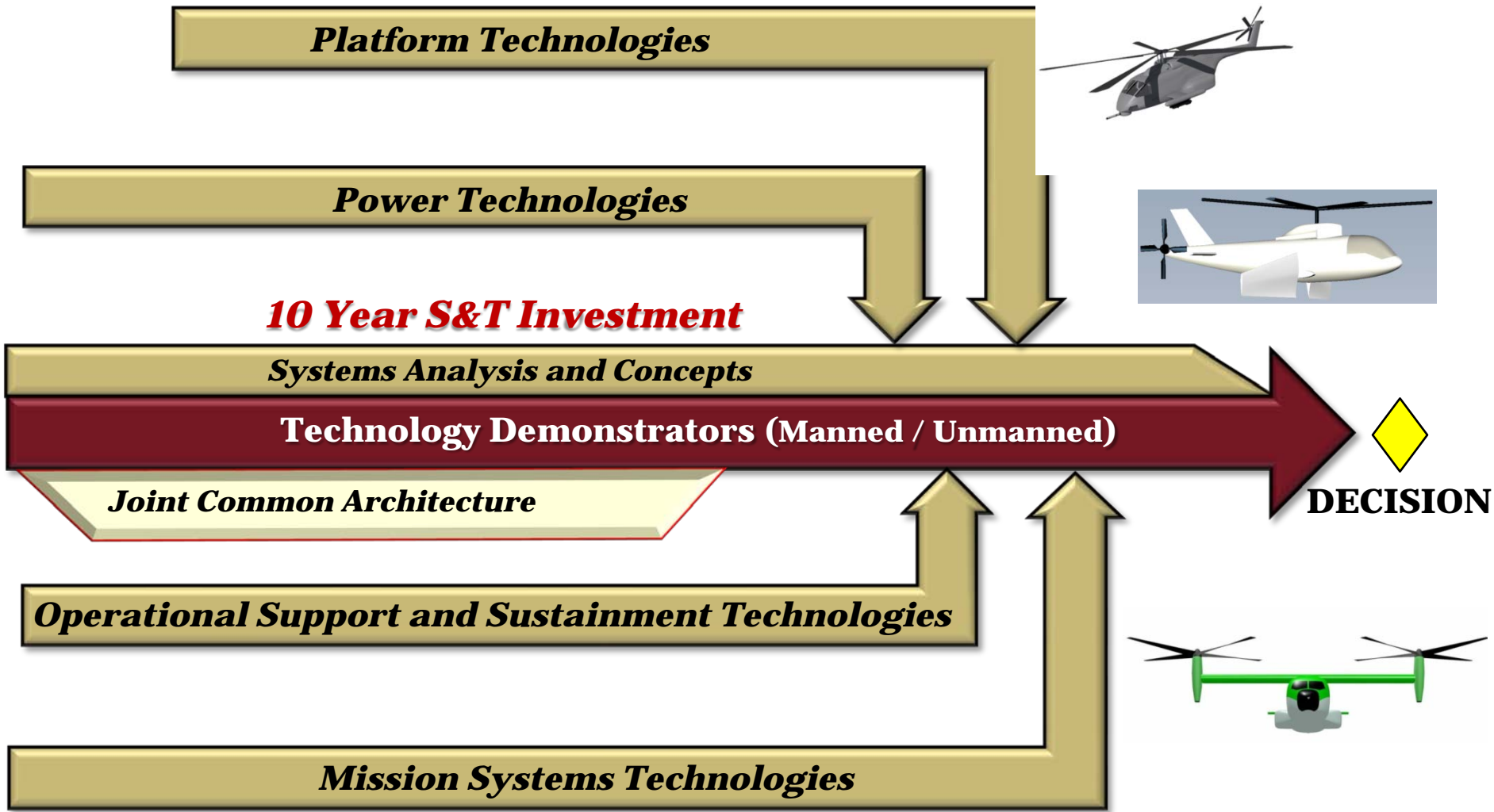
## Joint Multi-Role

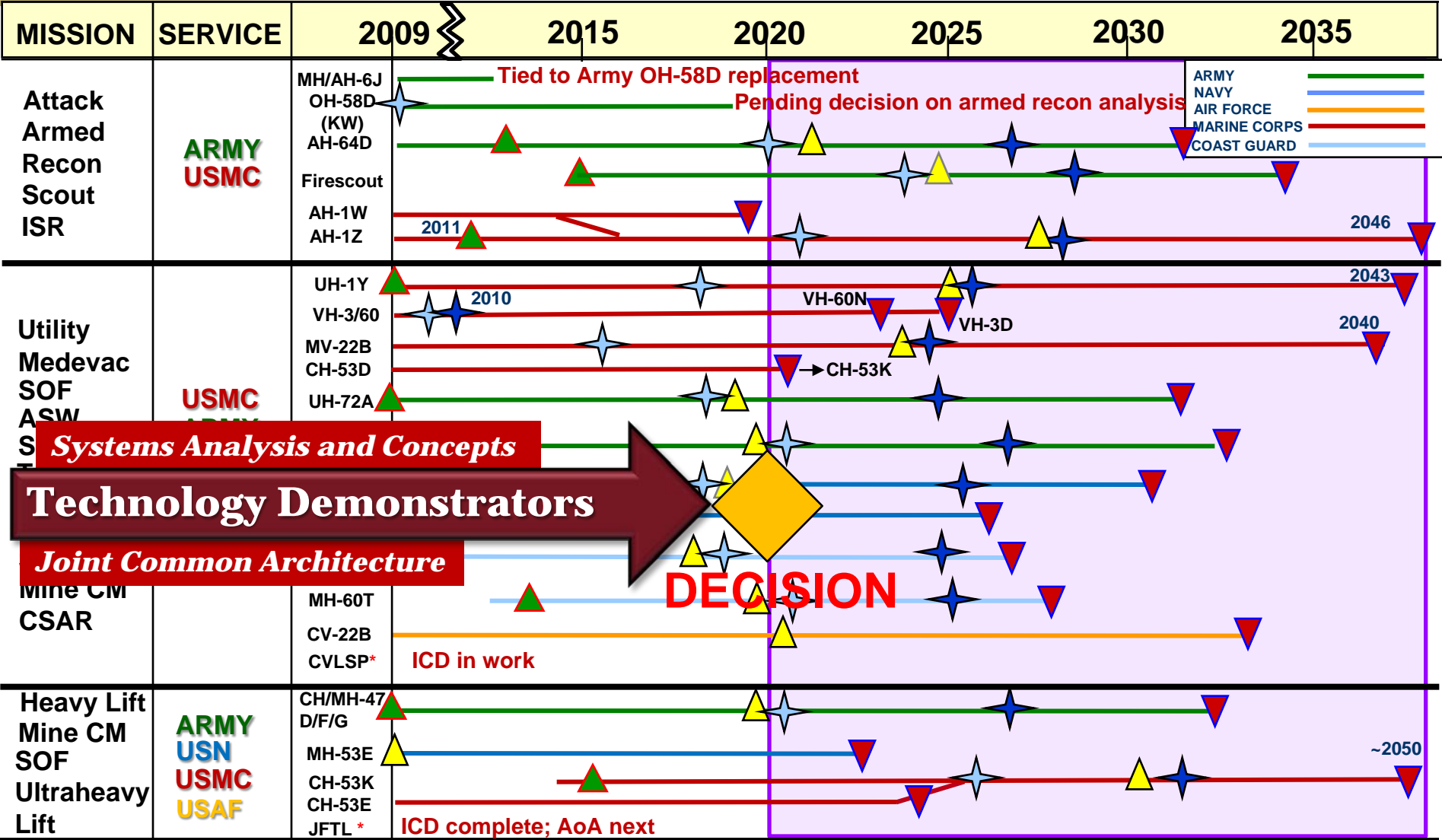




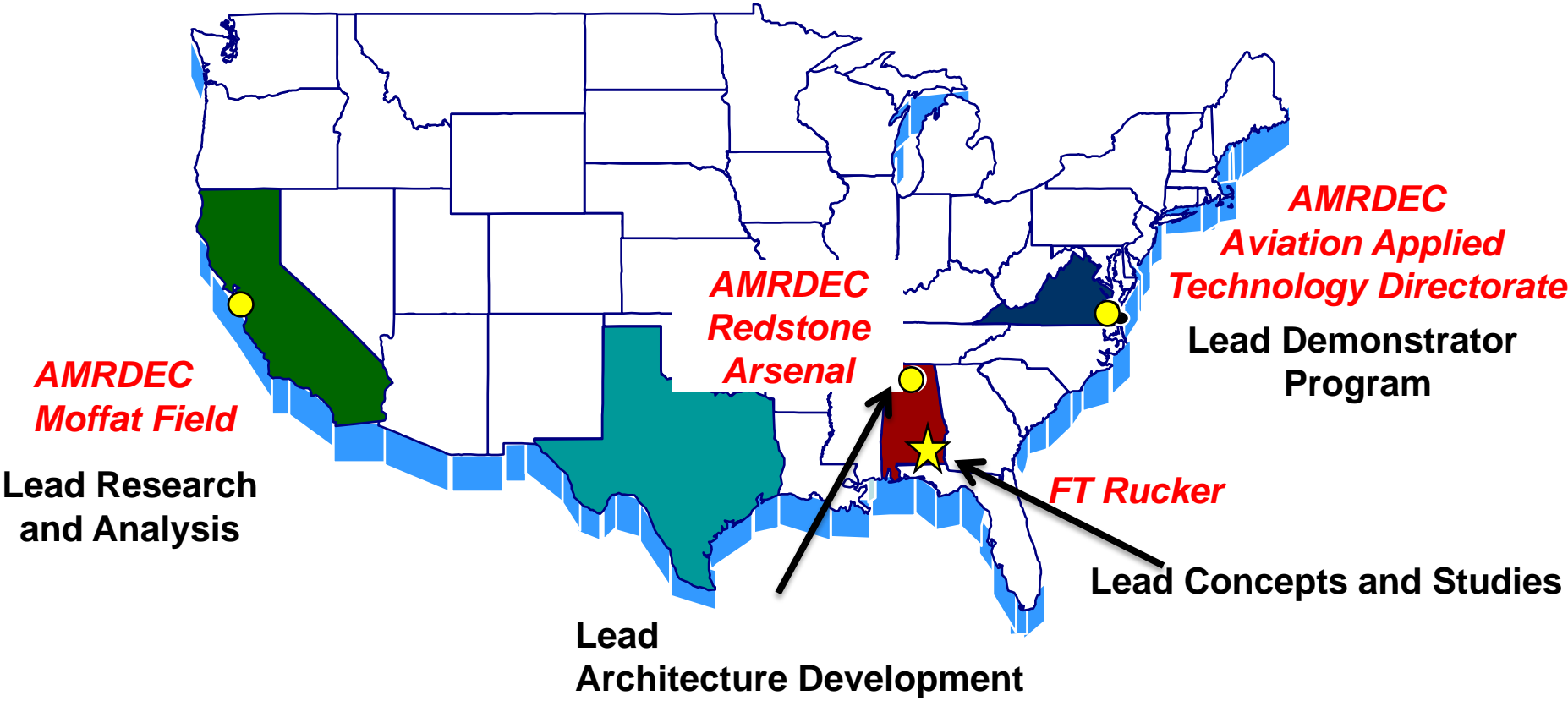
# Army Aviation Joint Multi-Role Development

FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
------	------	------	------	------	------	------	------	------	------	------	------





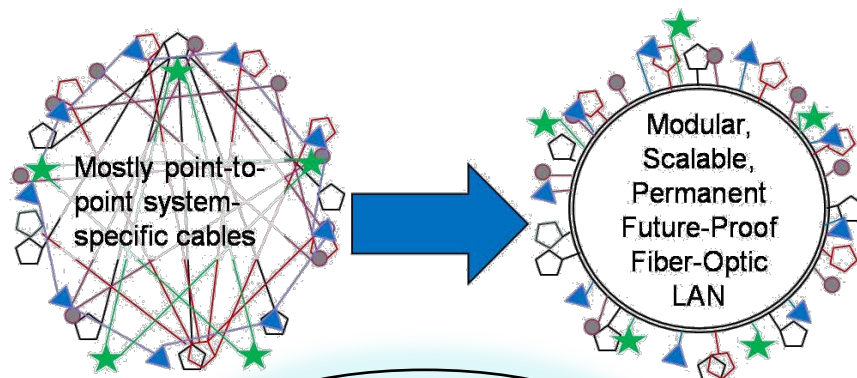






**Full Authority Control**

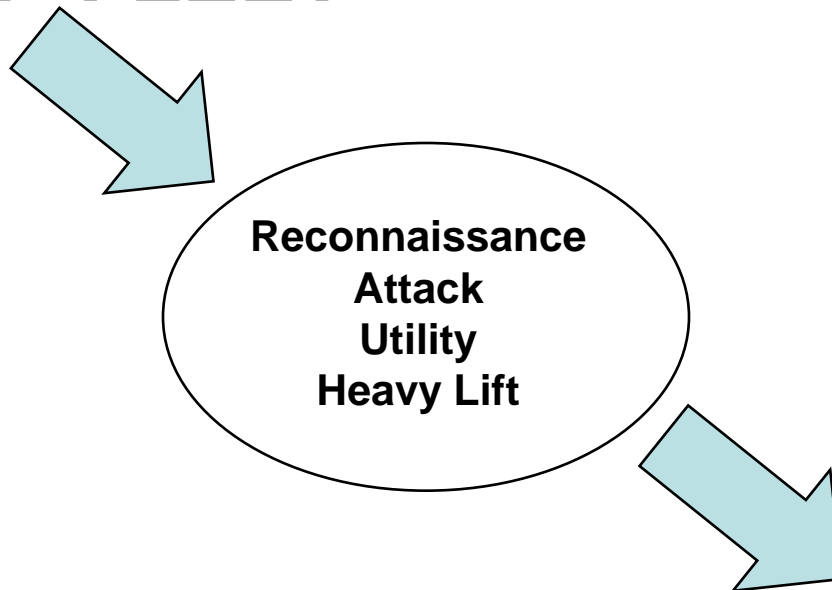
**Joint Common Open Architecture**



**Reconfigurable  
Fiber Network**

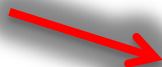
<ul style="list-style-type: none"> <li>• <b>Survivability</b> <ul style="list-style-type: none"> <li>– Signature Reduction</li> <li>– Aircraft Hardening</li> <li>– Redundancy</li> <li>– Speed</li> <li>– Active Protection</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>Situational Awareness</b> <ul style="list-style-type: none"> <li>– Virtual Cockpit</li> <li>– UAS Associates</li> <li>– Degraded Visual Environment (DVE) Control</li> <li>– Sensor Fusion</li> <li>– Foliage Penetrating Sensors</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>Affordability</b> <ul style="list-style-type: none"> <li>– On Condition Maintenance</li> <li>– Non-proprietary software</li> <li>– Commonality</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• <b>Performance</b> <ul style="list-style-type: none"> <li>– Hybrid Engines</li> <li>– Active Rotor Control</li> <li>– Swashplateless</li> <li>– Variable Geometry Rotors</li> <li>– Sea Based</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>Network</b> <ul style="list-style-type: none"> <li>– GIG Compatibility</li> <li>– Multi-level Security</li> <li>– SW driven waveforms</li> <li>– Integrated Assured Comms</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>Lethality</b> <ul style="list-style-type: none"> <li>– Directed Energy</li> <li>– Scalable</li> <li>– Auto/Ai Target recognition</li> <li>– Selectable yield warheads</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• <b>TBD</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>TBD</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>TBD</b></li> </ul>

## CURRENT FLEET



**JMR**

# Airframe Growth 6000/95F / Mission Profile



• Aviation platforms, must perform these tasks to standard, worldwide, in conditions ranging from standard sea level to high/hot (6k Pressure Altitude / 95 Deg F) across the full spectrum of environmental conditions.

• The utility and cargo fleet should carry their combat loads up to a 424 km unrefueled radius with 30 minutes station time; while, attack and reconnaissance aircraft should meet the 424 km unrefueled radius with 120 minutes station time.

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**



**424 Km / 120 Minutes Station Time**

**6K 95°**

**200+ Knot Cruise**



# CAN WE SUCCEED?



**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**